(1) The larger part of the Sierra Nevada, excluding the foothills, appears to have an average seasonal variability of over 30 per cent.

(2) West of this lies a long belt which includes most of the foothills and a considerable strip along the eastern side of the Interior Valley, where a variability under 30 per cent is characteristic. This belt seems to be continued in a fan-shaped area northward and northeastward into the semiarid region of northern California.

(3) West of No. 2 variabilities increase, so that a large part of the eastern Interior Valley and all of its western part, together with a considerable portion of the Coast Range country north of San Francisco Bay, show variabilities well over 30 per cent.

Between region 3 and the coast one may distinguish two fairly definite regions, as follows:

(4) In the northern Coast Ranges, in an area which includes perhaps the western third of them, variabilities are considerably lower than they are east of this region. There is also an apparently well-marked increase in variability from about 20 per cent in the northern part of the area to about 30 per cent around San Francisco Bay. Tracing the figures still southeastward within the Coast Ranges, one finds them rising irregularly to well over 40 per cent in the ranges north of Monterey Bay, decreasing to somewhat under 40 in the region east of the Bay, then rising to over 40 in the southern Coast Ranges.

(5) The southern Coast Ranges average distinctly higher in variability than the northern, the magnitude of it increasing southeastward and eastward into the high values of the southeastern desert.

(6) The southeastern desert is characterized by an extraordinary range of variabilities, including the unaccountably small variability at Lone Pine north of Owens Lake and the maximum value at Bagdad.

(7) Southern California west of the desert is, in the matter of average seasonal variabilities, clearly to be distinguished from the forbidding country at its back. Its variabilities largely stand midway between those of the desert rainfall and those of the fairly dependable rainfall in central and northern California. An exception to this condition is seen in the country north and east of San Diego, where the variabilities appear to be of the same order as those in central and northern California.

CONCLUSION

The foregoing material would seem to suggest that the most important subjects for future studies of this type on California rainfall should be:

1. With the frequency polygons here presented as a point of departure, the determining of the facts regarding (*a*) the relation of the most frequent seasonal totals of rainfall to the "normal" or arithmetical average amount; (*b*) the probabilities of occurrence of the most frequent amount; (*c*) the probabilities of occurrence of the "normal" amount; (*d*) the most probable seasonal amounts above and below the "normal."

2. The duration of periods (one or more seasons) of rainfall above and below the normal.

3. The averages of seasonal rainfall during periods of excess and deficiency.

The basis for such studies as those outlined above is constantly growing better. At this time (end of the 1924–25 rainfall season) five seasons in addition to those used in this paper have increased the value of the record. Many stations formerly in the "short-period" group now have moved into the "long-period" group and have data for 25 seasons or more. What is perhaps of greater importance is the increase in the number of stations having at least 10 seasons of record. These should, by filling many a gap in the *réseau* of stations, greatly aid in any future work on the problem.

NOTES, ABSTRACTS, AND REVIEWS

INTERNATIONAL COMMISSION FOR THE INVESTIGATION OF THE UPPER AIR

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A meeting of the International Commission for the Investigation of the Upper Air was held in London on April 17–22.

At the meeting of the commission in Bergen in July, 1921, the commission adopted the view that the international publication of the results of the investigation of the upper air ought to be resumed, and that an international bureau should be established and supported by contributions from the different States, so that the preparation and compilation of the results should not in future be done at the sole cost of the national service which undertook the work. Unfortunately, it did not prove practicable, in the stringent economic times which followed the meeting of 1921, to obtain the funds which were necessary to carry out the recommendations of the meeting at Bergen. In consequence of this, Prof. V. Bjerknes, who had been president of the commission, resigned his position, as he could not spare the time from his purely scientific work to carry out unaided the large amount of work involved in the preparation and publication of the international upper air results. Sir Napier Shaw, then president of the International Meteorological Committee, took over the presidency of the commission at the request of the members.

Various methods for securing the object of an international publication of upper air results have been considered or tried experimentally since that time. No satisfactory solution of the question has been achieved. A short meeting of the commission was held after the international conference at Utrecht in 1923 at which the results of the inquiries were briefly surveyed, and a preliminary discussion took place on the most appropriate form for an international publication.

In 1924, at the meeting of the International Union for Geodesy and Geophysics at Madrid, the union voted the sum of 500*l.* toward the expenses of publication of a specimen volume of upper air data, and Professor van Everdingen, the director of the Meteorological Institute of Holland, promised a contribution of about 100*l.* for the same purpose.

The meeting of the commission in London was concerned primarily with the consideration of the form which the specimen publication should take. Representatives from the following countries attended: France, Captain Wehrlé; Germany, Professor Hergesell; Great Britain, Sir Napier Shaw, Sir Gilbert Walker, Capt. C. J. P. Cave, Lieut. Col. E. Gold, Mr. L. H. G. Dines, Mr. L. F. Richardson; Holland, Professor van Everdingen, Professor van Bemmelen; Italy, Lieut. Col. Matteuzzi, Professor Gamba; Norway, Doctor Hesselberg; Russia, Doctor Molchanoff; Spain, Colonel Meseguer. The meetings of the commission were divided

into business meetings and scientific meetings, on the ground that a right solution of the questions which the commission had to consider could only be achieved by a correct appreciation of the scientific principles involved. There were four business meetings and three scientific meetings.

At the first meeting of the commission on Friday, April 17, the president read a letter from Mr. la Cour, director of the Danish Meteorological Service, giving the commission the welcome news that four wireless stations would be in operation in Greenland during the coming summer, at Angmagsalik, Julianehaab, Godthaab, and Godhavn; and that all four stations would be equipped with instruments for observations of pilot balloons. The work of the four stations as regards investigation of upper wind would be coordinated by wireless with the view of obtaining simultaneous ascents to great heights from all stations at the same time.

In a communication from M. Fontséré, Barcelona, an account was given of some observations on oscillations of short period, indicated by the well known oscillations of the motion of pilot balloons, as seen in a pilot balloon theodolite. These oscillations appear to have a period of about three seconds, and do not appear to be due to natural oscillations of the balloon. The commission decided to recommend that a similar investigation should be undertaken in other places, and that the influence of the size and form of the balloon on the character of the oscillations should be explored and that a comparison of the oscillations observed in balloons with those observed in the tension of kite wires should also be made.

After some discussion of the use that should be made of the funds placed at the disposal of the president, the commission decided that they should be applied to the publication of a specimen volume of upper air results for 1923 and 1924, and that in the specimen volume the observations obtained from *ballon-sonde* and similar records from the places selected for international investigation, should be published in the form of tables giving full details, and that the tables should be supplemented by graphical representation on "tephigrams." This is the name given to the representation of the results of the *ballon-sonde* ascents, by plotting corresponding values of temperature t, and entropy ϕ, which is proportional to the logarithm of potential temperature T. This form of representation, which was invented by the president and explained by him at the scientific meeting, is peculiarly appropriate for presenting the results of temperature (and humidity) observations in the upper air. It shows immediately the relation of the temperature gradient observed in the ascent to the adiabatic gradient for dry air and the adiabatic gradient for saturated air. It shows the energy which would be required to raise air vertically in the atmosphere under the conditions of the ascent, or alternatively, the energy that would be set free in a kilogram of air rising in the atmosphere under the conditions of the ascent. It also has the great advantage of presenting these results in a diagram of very moderate dimensions, even when observations at heights of 50,000 feet or more are included.

Considerable discussion took place on a proposal sent by Doctor Marvin for concentrating all the international *ballon-sonde* ascents in any one year into a single month. The proposal to obtain ascents daily for a month in addition to ascents on single days in other months of the year, was advocated by Lieutenant Colonel Gold at the meeting at Bergen in 1921, but it was rejected by the commission on the ground that the funds available for upper-air investigation should be devoted to obtaining results for detailed investigation on the lines adopted by the Norwegian Geophysical Institute. After much discussion of Doctor Marvin's proposal, it was agreed that countries participating in the international investigation of the upper air should be asked to make, so far as possible, daily ascents distributed throughout a month in each year, the month to be selected by the International Commission, these ascents to be additional to those indicated in the scheme of international days prepared by the commission at Bergen for the years up to 1928. The first month selected for this more extended investigation is May, 1926, and the next month is October, 1927. (It was considered that the time was too short to warrant an "international month" in 1925, but it was agreed that any auxiliary *ballon-sonde* results which any country might be able to make, should be made in August.)

In the course of discussion of this resolution, Professor Hergesell emphasized that the international investigation of the upper air has two aspects, the world aspect and the regional aspect. From the world aspect, ascents over a month would be appropriate, and from the regional aspect, ascents concentrated into shorter periods of time, and made more frequently, would lead to better results. Doctor Simpson, following up this line of thought, made the suggestion that the commission itself should deal only with the world aspect and should appoint regional subcommissions to deal with regional aspects. The commission eventually decided that the regional aspect could, in the meantime, be dealt with satisfactorily by the nomination of deputy presidents in the following different regions: Europe, with Russia, Siberia, and North Africa; North America; the East Indies and the Philippines; Australia; South Africa; South America. It was agreed that the six ascents left at the disposal of the president should be concentrated in the international months, and the exact dates in the different regions should be left to the deputy presidents for these regions. Doctor Marvin was designated as deputy president for North America and Mr. J. H. Field for the East Indies.

The question of adopting an international formula for the rate of ascent of balloons, put forward by Doctor Weinberg (Leningrad), led to the appointment of a subcommission to consider this and other questions relating to balloons, and to report to the next meeting of the commission. The members of the subcommission are: Professor Hergesell, president, Doctor Hesselberg, Mr. J. S. Dines, Doctor Molchanoff, Colonol Matteuzzi, Doctor Marvin, and Mr. Fujiwhara.

The importance of airplane observations, and the difficulty of securing satisfactory instruments for them, was emphasized by Captain Wehrlé, and the commission decided to ask for complete particulars of the instruments and methods used in different countries to be communicated, with the view of their publication in collected form by the French meteorological service.

As regards the future, it was decided that the question of a regular international publication could only be settled satisfactorily after the specimen volume had been issued and considered. The question of the publication of results after 1924 was, therefore, remitted to the next meeting of the commission, which it is anticipated will be held at Prague in 1927.

* * * The outstanding impression left by the meeting may be illustrated by a remark to me of one of the foreign delegates:

> What I like about this international work is the way everybody is ready to help things forward; the only consideration being, "Is the thing good?" It is very pleasant.
>
> E. GOLD.

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